

_____ CURING

NOTE TO SPECIFIERS: The "general" subparagraph should be modified to suit conditions at each job.

a. General. - The Contractor shall furnish all materials and perform all work required for curing concrete. Concrete surfaces shall be cured by the applicable method specified in tables _____ (Formed surfaces) and _____ (Unformed surfaces) in paragraph _____ (Finish, Surface Tolerances, and Curing Schedule).

All concrete surfaces shall be treated as specified to prevent loss of moisture from the concrete until the required curing period has elapsed or until immediately prior to placement of other concrete or backfill against those surfaces. Only sufficient time to prepare construction joint surfaces and to bring them to a surface-dry condition shall be allowed between discontinuance of curing and placement of adjacent concrete.

As soon as unformed concrete surfaces have been finished, as specified, and have attained a dull appearance free from bleed water and moist sheen, they shall be treated as specified herein.

Forms shall be removed within 24 hours after the concrete has hardened sufficiently to prevent structural collapse or other damage by careful form removal. Where required, repair of all minor surface imperfections shall be made immediately after form removal. Minor surface repair shall be completed within 2 hours after form removal and shall be immediately followed by the initiation of curing by the applicable method specified in table _____ (Formed surfaces) in paragraph _____ (Finish, Surface Tolerances, and Curing Schedule). Concrete surfaces shall be kept continuously moist after form removal until initiation of curing.

The Government will ¹(test or) (require approved manufacturer's certification of) all curing compound prior to use. However, acceptance under clause in subsection I.3 entitled "Inspection of Construction," will not be made until the material has been satisfactorily applied at the jobsite.

b. Submittals. - Submittals of purchase orders, certifications, and samples, if required, shall be in accordance with this paragraph and paragraph _____ (Submittal Requirements).

The Contractor shall be responsible for the accuracy of all certifications submitted and data contained therein whether submitted by him, a manufacturer, or a subcontractor. The costs and delays that result from rejection of materials or inadequate certifications shall be the responsibility of the Contractor.

(1) Purchase orders. - At least ¹(90) days prior to shipment of curing compounds the Contractor shall submit two copies of all purchase orders for curing compound the Contractor proposes to furnish.

The Contractor will be informed in writing whether materials covered by each purchase order will be accepted on manufacturer's certification of compliance or if testing by the Government will also be required.

¹[(2) Materials which will be accepted on manufacturer's certification of compliance. - At least ¹(45) days prior to shipment of the curing compound the Contractor shall submit the manufacturer's certification certifying that the material is within 1 percent (by weight of each individual constituent) of the same composition as material which previously has been found to comply with the specifications when completely tested. The certification shall fully identify the manufacturer, batch number, materials identification, and quantity. In addition, compliance certification from the manufacturer of the CRC-101 curing compound shall include the composition of the materials furnished.

Within 16 days after receipt of the certifications, the Government will notify the Contractor whether the certifications conform to specifications requirements.

(3) Materials which require testing by the Government. - At least ¹(75) days prior to shipment of the curing compound the Contractor shall submit samples of curing compound requiring testing by the Government. Each sample shall be 1 quart in size and included with each sample shall be a certification that the sample is from the actual batch from which shipments are to be furnished. Samples and accompanying certifications shall be fully identified by manufacturer's name, batch number, materials identification, and quantity.]

c. Materials. - Materials used for curing shall meet the following requirements:

(1) Water. - Water used for curing shall meet the applicable requirements of paragraph ____ (Water) for water used in mixing and curing concrete.

(2) Curing compound. - Wax-base and water-emulsified, resin-base curing compounds shall conform to the requirements of Water and Power Resources Service "Specifications for Concrete Curing Compound" dated October 1, 1980.

⁶(CRC-101 curing compound shall conform to the requirements of Water and Power Resources Service "Specifications for Clear Resin-base Curing Compound CRC-101," dated January 1, 1981.)

Curing compounds shall be of uniform consistency and quality within each container and from shipment to shipment.

(3) Polyethylene film. - Polyethylene film for curing concrete shall be ²(clear or) white and shall conform to the requirements of ASTM C171.

³{ _____. Water curing. - Concrete cured with water shall be kept wet for at least 14 days from the time the concrete has attained sufficient set to prevent detrimental effects to the concrete

surfaces. The concrete surfaces to be cured shall be kept wet by covering them with water-saturated material; by using a system of perforated pipes, mechanical sprinklers, or porous hose; or by other methods which will keep all surfaces continuously (not periodically) wet. All curing methods are subject to approval by the Contracting Officer.

⁴[Water curing of concrete shall be discontinued after 6 days during periods when the mean daily temperature in the vicinity of the worksite, as determined by the Contracting Officer, is less than 40 EF (5 EC). If during the prescribed period of water curing, ambient temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued.]]

⁵{____. Curing with compound. - Curing by wax-base or wateremulsified, resin-base ⁶(or CRC-101) curing compound shall be by application to designated concrete surfaces to provide a waterretaining film. The curing compound shall be reapplied as necessary to maintain a continuous, water-retaining film on the surface for 28 days. The curing compound shall be mixed thoroughly and spray applied to the concrete surfaces in one coat to provide a continuous, uniform film over the concrete. The coverage rate shall not exceed 150 square feet per gallon (3.7 square meters per liter for wax-base or wateremulsified, resin-base compound ⁶[and 200 square feet per gallon (4.9 square meters per liter) for CRC-101 compound]. On rough surfaces, the coverage rate shall be decreased as necessary to obtain the required continuous film. Special care shall be taken to ensure ample coverage with the compound at edges, corners, and rough surfaces; and to keep curing compound off waterstops and reinforcing bars. Equipment for applying curing compound and the method of application shall be in accordance with the provisions of chapter VI of the Eighth Edition 1981 Revised Reprint of the Bureau of Reclamation "Concrete Manual." }

⁶(In applying CRC-101 curing compound, care shall be taken to produce a uniform, continuous film, and to avoid sagging, puddling, and excessive thickness. To prevent sagging on surfaces which are not horizontal, application shall consist of two or more passes over each point on the surface, using a cross-spraying technique, and with a time interval between passes not exceeding 30 minutes. The application shall be performed by personnel qualified, as determined by the Contracting Officer, in using the specified spray techniques. The compound shall be applied in a manner conforming with safe control proceedings outlined in the Bureau of Reclamation Occupational Health and Safety data sheet on CRC-101 curing compound.)

In order to ensure bond of curing compound, the Contractor shall, where and as directed by the Contracting Officer, remove excessive form oil from concrete surfaces by washing with a solution of trisodium phosphate, followed by a thorough rinsing of the surfaces with clear water. The trisodium phosphate wash will be required when it is determined by the Contracting Officer that the amount of form oil on the concrete will impair the bond of the curing compound or when surfaces are exposed to public view.

Where curing compound is to be applied, formed concrete surfaces shall be kept continuously moist by repeated light spraying with water until immediately prior to application of curing

compound. Curing compound shall be applied as soon as the surface film of moisture has disappeared, but while the concrete still has a damp appearance.

After application of the curing compound has been completed and the coating is dry to touch, all remaining required concrete repairs shall be performed without delay in accordance with paragraph ____ (Repair of Concrete). Completed repairs shall be moistened and coated with curing compound in accordance with the foregoing requirements.

⁷(____. Polyethylene film curing. - Curing by this method shall be by completely covering the designated concrete surfaces with polyethylene film to provide an airtight, water-retaining film over the entire concrete surface for at least 14 days. As soon as the concrete has hardened sufficiently to prevent damage, all surfaces shall be thoroughly moistened by spraying them lightly with water and then covering them completely with polyethylene film. Edges of the polyethylene strips shall be lapped to effect a seal to adjacent strips and, at the extreme edge of the curing area, held tightly against the concrete surface. The polyethylene film shall be adequately secured to withstand wind and to prevent circulation of air inside the curing film.)

¹(____. Protection of curing membranes. - Curing compound membranes shall be maintained to provide a moistureproof membrane for curing concrete for the minimum period specified. Curing compound that is damaged, or that peels from concrete surfaces within 28 days after application, shall be repaired without delay by moistening the concrete and applying additional compound in a manner satisfactory to the Contracting Officer.

Polyethylene film curing shall be sustained for at least 14 days. The polyethylene film shall be protected as necessary to keep it intact, and the concrete surface shall be kept moist for the full curing period.

Where foot traffic or other construction activity is necessary on concrete being cured by curing compound or polyethylene film, the curing membrane shall be protected by covering with sand or earth not less than 1 inch thick, with plywood, or by other effective means approved by the Contracting Officer. Protective covering shall not be placed on curing compound until the compound is dry. The Contractor shall remove protective coverings before final acceptance of the work.)

____. Cost. - The cost of furnishing all materials and performing all work for curing concrete as required by this paragraph including the submission of submittals shall be included in the applicable price(s) bid in the schedule for the items of concrete for which the particular curing methods are required.

¹Revise as required to include those requirements for the types of curing compound required.

²Delete reference to clear polyethylene if the reflectance of white sheeting is required to prevent the temperature of the concrete from becoming excessive due to the sun's radiation, such as with thin, horizontal slabs in a warm climate.

³Include this subparagraph when water curing is required or permitted for any part of the concrete work.

⁴Delete in areas of mild climate.

⁵Include this subparagraph with appropriate compounds when curing by application of wax-base, water-emulsified resin-base, or CRC-101 curing compound is required or permitted for any part of the concrete work.

⁶Include this when curing by application of CRC-101 curing compound is required or permitted for any part of the work.

⁷Include this subparagraph when curing by polyethylene film is required or permitted for any part of the concrete work.

5-23-88 Revisions: Revised throughout; edited for separate submittals subparagraph b.